Chapter 7

Marine Fisheries in Nigeria: A Review

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Additional information is available at the end of the chapter

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Abstract

Fisheries production especially from marine is important for the socio-economic development of Nigerians and its contribution to the nation's economic growth through the Gross Domestic Product (GDP). Nigeria is blessed with enough marine fisheries resources that could enhance increased fish production. Yet, fish supply from domestic production is far below the fish demand of her citizens. This chapter is therefore focused on marine fisheries in Nigeria. We adopted a desk review approach. This chapter is divided into different sections such as the Nigerian fisheries sector, marine fisheries resources in Nigeria, status of marine fisheries production in Nigeria, marine fisheries regulations, and constraints to optimal marine fisheries production in Nigeria. We concluded that the contribution of aquaculture to marine fisheries production has been low, compared to the marine capture fisheries production. Also, we noted that despite the availability of regulations, noncompliance by fisher folks has not helped to optimize marine fisheries production. We therefore recommended that the culture of marine fishes should be intensified. Marine waters should also be protected against destruction and pollution as a result of human activities. Available marine fisheries regulations should be enforced and violators of the regulations should be punished as stipulated in the regulations.

Keywords: marine fisheries, fisheries regulations, fisheries resources, optimal fisheries production, sea fisheries decree

1. Introduction

Nigeria is a maritime state where 9 of the 36 federal states have a coastline in the Atlantic Ocean. The coastal federal states of Nigeria are Ogun, Lagos, Ondo, Edo, Delta, Bayelsa, Rivers, Akwa Ibom, and Cross Rivers States, found in the southern part of the country. The importance of the fisheries sector to individuals and the economy of many developed and

developing countries cannot be overemphasized. It is notable that fish provides more than 60.0% of the world's supply of protein, especially in developing countries [1]. Its importance could be felt directly and indirectly among rural and urban residents in Nigeria. In Nigeria, fisheries, particularly an important subsector, contributes about 3.00–5.00% to the agriculture share of the Gross Domestic Product (GDP). Fish are an important protein source in the diet of Nigerians. Protein from fish is highly digestible and of high nutritional value and consists of complete arrays of amino acids, vitamins, and minerals [2]. Apart from its high quality, fish is a cheaper source of protein compared to other animal protein sources such as beef, pork, chicken, and goat meats [3].

The fisheries subsector of the Nigerian agriculture is an essential tool for rural development through its provision of income, high-quality protein, and socioeconomic development of fishing communities in Nigeria [4]. The relevance of the fisheries sector to the Nigeria economy and benefits derived by Nigerians from fish and other fish products led to the high consumption and hence the increased demand for fisheries products. In order to meet up with increasing demand for fisheries products, Nigerian federal governments have tremendously implemented a series of projects targeted at increasing the local supply of fish [5]. Thanks to some of the projects like second and third phases of Fadama, although some improvements were recorded in terms of output level of fish, the gap between the demand for and supply of fish keeps increasing as a result of the use of traditional fishing methods, as is the artisanal fishery, which has the major source of protein from fish relied on, despite the increasing growth rate of the Nigerian population. Government's effort on the fisheries sector is however directed to the popularization and adoption of aquaculture, which is currently the fastest food industry globally at the neglect of the artisanal fishery.

This has led to the government's resolve to augment fish supply with importation of frozen fish and other fish products. Several reports have indicated that several millions of the Nigerian currency is being expended on fish importation [6]. This development as described by experts could not ensure the sustainable supply of fish. It is in fact regarded as a mere waste of the national resources that could have been directed to the development of the fisheries sector. Despite the neglect of the artisanal fishery, it provides the largest proportion of domestic fish supply in Nigeria [7]. Artisanal fishery in Nigeria is from two main sources that are the marine and inland fresh water capture fisheries with up to sixty percent of the artisanal fishery coming from marine water bodies. It is the belief of this chapter that if as much attention paid to the aquaculture of inland fisheries could be given to the marine aquaculture fishery, the domestic fish production in Nigeria has the potential to outstrip the fish demand in the country.

The rest of this chapter is divided into five sections, which are on (1) describing the fisheries sector in Nigeria, (2) examining the marine fisheries resources in Nigeria, (3) the status of marine fisheries production in Nigeria, (4) the marine fisheries regulations in Nigeria, and (5) the constraints to optimal marine fisheries production in Nigeria. Based on our discussion, recommendations were made on means to increase local fish supply in Nigeria through the marine fisheries.

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2. The Nigerian fisheries sector

The fisheries sector is crucial to the Nigerian economy for contributing about 5.40% of the nation's Gross Domestic Product (GDP) [8, 9]. It is noted that fishery is an important economic sector in terms of employment, food security, enterprise development, and foreign exchange earnings and also important in terms of the livelihoods of many rural people and nutrition. The importance of the fishery sector is such that it is the most common and cheapest animal protein source to mankind especially among the poor dwellers in Nigeria [10]. Nigerians have been regarded to have a huge appetite for fish with an annual demand of 1.50 million metric ton [10]. This figure has since been on the increase such that [11] projected the fish demand as 2.055 million metric ton in 2015.

Based on sources, the fish supply to meet the increasing fish demands by Nigerians is from two major groups, which are the domestic production of fish and importation of fish. Importation has served as a major supply of fish in Nigeria providing more than half (56.0%) of fish supply [12]. Fish importation refers to the supply of fish to Nigeria from foreign countries in order to augment the locally produced fish in the country. According to Agbo [13], Nigeria spent over ₦125 billion per annum on importation of 1.90 million metric ton of fish in 2015. According to FMARD [14], Nigeria spent ₦97 billion on fish in 2010 alone in spite of all the endowed marine resources, rivers, lakes, and creeks of the nation. Based on the study of Vaughan et al. [15] on analysis of major food imports obtained from the National Bureau of Statistics, fish was the second major food commodities with highest import bills in the period 2006–2010 with an annual average of ₦113.63 billion. The relevant figures indicated that the value of fish imports keeps increasing and this has been attributed to the increasing growth rate of the Nigerian population, while domestic fish production only increases at decreasing rates. Olaoye et al. [7] reported that the quantity of fish imported rose from 557,884 tons to 739, 666 tons between 2000 and 2007 with foreign exchange value on importation being $241,065.54 million and $594,373.69 million in 2000 and 2007, respectively. With these figures, Nigeria has been considered as the largest importer of fish in developing world [7, 16–19].

Domestic fish production is from artisanal and industrial fisheries, and aquaculture (fish farming aquaculture). Artisanal fishery refers to the harvesting or capturing of fishes from natural water bodies such as rivers, streams, lakes, and ponds by small scale fisher folks using both traditional and modern fishing gears [20]. According to Olaoye et al. [21], stakeholders in artisanal fishery include local fishermen and women who fish either on part-time or full-time basis employing all sorts of gears and techniques, which may be destructive, cheap, and locally sourced. It is usually operated at subsistence level (although, some are for commercial purposes) in rural areas. It is a nonindustrial fishery that covers the activities of small-scale canoes operating in the coastal areas, creeks, lagoons, inshore water, and the inland rivers [22–24]. Artisanal fishing involves the use of crude fishing tools and implements, little or no credit and lack of infrastructural facilities, and lack of skills [25, 26]. Due to its operation at subsistence level, it is known as the small-scale fisheries and traditionally occupies the most important

component of domestic fish production, contributing up to 90% [27–30]. In buttressing their point, [31] noted that artisanal fisheries employ 18 times more fishermen than the industrial fisheries while supporting the welfare of over 100 million persons globally.

The industrial fisheries are a higher and mechanized level of fish production, which depends on the use of trawling vessels for fishing and shrimping in the territorial and offshore waters [23]. It refers to the industrial fishing in inshore and offshore water of the seas. The marine resources in these waters include demersal, pelagic, and shellfish resources, mainly shrimps, prawns, and crabs, that exist in commercial quantities. This sector is purely industrial and highly capital intensive requiring over N100 million for a one-boat operation [32]. The area of operation is at least 5 nautical miles. Its status is high capital outlay and advanced technology application; about N50.0bn is invested by the private sector in fishing vessels and onshore processing and handling facilities [23].

Aquaculture, to which fish farming belongs, is the commercial rearing of fish in conditions where all basic means of production can be controlled within their respective limitations and from which producers aim to obtain optimal economic results [18]. Scholars [33, 34] also defined aquaculture as the rearing of aquatic organisms under controlled or semicontrolled environments for the social and economic benefits of mankind and livestock. The aquatic organisms that could be reared include fish, insects, bivalves and pearls, mollusks, crustaceans, and aquatic plants, while the controlled environments include ponds, cages, pens, and raceways [18]. Based on the above definitions, fish farming that involves the rearing of fish species under human controlled environments for the economic and social benefits of mankind is a subset of aquaculture [4]. World Bank Group [35] viewed fish culture, also known as fish farming, as an efficient animal protein production system providing essential nutrition for over 1 billion people. It was further submitted that fish farming provides important services such as supporting nutritional well-being, source of feedstock for industries, contributing to rural development, increasing export opportunities, and enhancing more effective administration of natural resources and conservation of biological diversity [36, 37].

One merit of fish farming and aquaculture generally is that it allows overexploited species to be raised in the hatchery and then restock into the natural waters [21]. According to Ejiola and Yinka [38], aquaculture is the least exploited fishery subsector with the vast brackish water fishing grounds almost unexploited. One of the reasons is its neglect as a result of the expensive nature of aquaculture to most poor households. Aquaculture is currently the fastest growing livestock production sector in Nigeria and worldwide [4]. The contribution of the Nigerian aquaculture production has been increasing since 1995 with the contribution of 0.07% to world aquaculture production and 0.42% of world aquaculture production in 2014 [39]. The above classification into capture (fishing) and culture fisheries (aquaculture) is based on the culture/management system.

The next classification of fisheries is based on the type of environment or habitat where fish are reared or captured. This is classified broadly into brackish water, fresh water, and seawater/marine water fisheries. Fresh water refers to water without salt or marine origin, such as generally found in lakes, rivers, canals, dams, reservoirs, paddy fields, and swamps; marine water refers to inshore and open waters and inland seas in which salinity generally exceeds 20%, while

brackish water refers to mixed sea water and fresh water and salinity varies with the tide [40]. Examples of brackish water environments are estuaries, mangroves, and mouth of rivers, where sea water enters during high tide. Since this chapter is only concerned with marine fisheries, brackish water and fresh water fisheries shall be neglected, while attention is being concentrated on marine fisheries in the context of industrial, artisanal, and culture fisheries.

2.1. Marine industrial fisheries

This can be grouped into offshore tuna fishery, coastal demersal fish fishery, and coastal shrimp fishery. Tuna is mainly found in the off-shore tuna fishery and forms part of the large Gulf of Guinea stocks. Off-shore resources are located between the country's territorial limit (30 nautical miles) and the exclusive economic zone (EEZ) (200 nautical miles). Nigeria is yet to actively participate in the exploration of the offshore tuna resources due to technical constraints [1]. In the coastal demersal fish fishery, the trawling industry is well developed and organized under the Nigerian Trawler Owners' Association (NITOA). There are 40 trawling companies in Nigeria. Most of the companies are owned by Nigerians. Those Nigerian companies have fleet sizes of less than four while larger companies, with fleet sizes of four or more are owned in partnership with foreign investors [1]. The shrimping industry in Nigeria is operated on the continental shelf from 5 nautical miles with vessels licensed in accordance with the provisions of fisheries law and regulations.

2.2. Marine artisanal fisheries

This can be categorized into coastal canoe fishery, brackish water or estuarine canoe fishery, and artisanal pelagic fish bong shad and Sardinella fishery. The coastal canoe fishery is operated within the 5 nautical miles nontrawling zone, but due to motorization and targeted stocks, some operators may venture farther into the sea. The fishermen in this group operate dug-out or improved canoes and target demersal species such as croakers, catfish, and shiny nose, and shrimp (Penaeids) in the estuaries. The artisanal pelagic fish bond and Sardinella fishery are low-technology, labor-intensive fisheries using canoes 6 to 13 m long either paddled or motorized. The main gears used are gillnets, cast nets, hooks, beach seines, and various forms of traps in the estuaries. The fishermen target small pelagic, *Sardinella* spp. and *Ethmalosa* spp.

3. Marine fisheries resources in Nigeria

Fisheries resources are fishery products or output that comes from fishing and aquaculture [41]. Fishing resources consist of products from open water bodies like rivers, lakes, reservoirs or dams, and oceans, while aquaculture resources include fishery products from enclosed environments such as ponds, tanks, dams, and reservoirs. Nigeria is blessed with a land area of 923,768 km^2, an 853 km coastline, and a 200 nautical miles exclusive economic zone (EEZ). In addition, the country is endowed with marine waters of 30 nautical miles [43]. Within the EEZ, Nigeria has exclusive rights to the exploration and exploitation of the fishes and other

natural resources [42]. Artisanal fishing was supported in the brackish and coastal waters of Nigeria industrial fishing could only be operated outside the 5 nautical miles restriction of the 1992 Sea Fisheries Act. According to Onyema [44], nine of the 36 federal states in Nigeria have a coastline with the Atlantic Ocean.

At the marine artisanal level, fisheries resources include fish belonging to Sciaenid community including croakers and bonga, shad, catfish, sardines, soles, shiny-nose, etc., *Polydactylus* spp. (polynemidae), as well as members of the Sphyraenidae, Lutjanidae, Elopidae, Serranidae, and Carangidae families. Sharks, sail/saw fishes, as well as penaeids, palaemonids, and carid shrimps are also caught by small-scale fishermen. The Nigerian industrial coastal fishing activities consist of trawling for demersal finfish, shell fish, and penaeid shrimps. There are about 104 marine fish species belonging to 50 families in Nigeria [45]. According to FAO [1], the species composition is dominated by croakers (*Pseudotolithus* spp.), grunts (*Brachydeuterus* spp.), various soles, catfish (Arius spp.), and shrimps (*Penaeus* spp.).

The finfish species are heterogeneous and belong to suprathermocline and subthermocline communities. The major target families/species of the suprathermocline community (i.e., sciaenids) include:

a. *Sciaenidae* (Croakers): *Pseudotolithus typus* (Bleeker, 1863), *Pseudotolithus senegalensis* (Valenciennes, 1833), *Pseudotolithus elongatus* (Bowdich, 1825), *Pseudotolithus senegalensis* (Cuvier, 1830), *Brachydeuterus auritus* (Valenciennes, 1832), *Selene setapinnis* (Mitchill, 1815)

b. *Ariidae* (Catfish): *Carlarius heudelotii* (Valenciennes, 1840), *Arius gigas* (Boulenger, 1911), *Arius latiscutatus* (Günther, 1864), *Arius parkii* (Günther, 1864)

c. *Haemulidae* (Grunters): *Pomadasys jubelini* (Cuvier, 1830), *Pomadasys suillus* (Valenciennes, 1833), *Pomadasys incisus* (Bowdich, 1825), *Pomadasys perotaei* (Cuvier, 1830)

d. *Cynoglossidae* (Tongue Sole): *Cynoglossus senegalensis* (Kaup, 1858), *Cynoglossus canariensis* (Steindachner, 1882), *Cynoglossus monodi* (Chabanaud, 1949) and *Cynoglossus browni* (Chabanaud, 1949)

e. *Polynemidae* (Threadfins): *Polydactylus quadrifilis* (Cuvier, 1829), *Galeoides decadactylus* (Bloch, 1795)

f. *Carangidae* (Jackfish): *Caranx hippos* (Linnaeus, 1766), *Caranx crysos* (Mitchill, 1815), *Caranx latus* Agassiz, 1831, *Caranx lugubris* (Poey, 1860)

g. *Sphyraenidae* (Barracudas): *Sphyraena barracuda, Sphyraena afra, Sphyraena guachancho*

h. *Clupeidae: Sardinella* spp.

The sparid community comprises mainly the following major families and species:

a. Lutjanidae (Red snappers): *Lutjanus goreensis* (Valenciennes, 1830), *Lutjanus fulgens* (Valenciennes, 1830), *Lutjanus agennes* (Bleeker, 1863) and *Lutjanus dentatus* (Duméril, 1861)

b. Serranidae (Groupers): *Epinephelus aeneus* (Geoffroy Saint-Hilaire, 1817)

c. Sparidae: *Dentex canariensis* (Steindachner, 1881), *Dentex angolensis* (Poll & Maul, 1953), *Dentex congoensis* (Poll, 1954)

d. Breams: *Pagrus* spp., *Pagellus bellottii* (Steindachner, 1882) *and Pagus* spp.

Fishery resources in the inshore shrimp industry include the following in order of importance:

a. White prawn (*Penaeus notialis*) (Pérez Farfante, 1967)

b. Brown or Guinea shrimp (*Holthuispenaeopsis atlantica*) (Balss, 1914)

c. Rose or red deep-water shrimp (*Parapenaus longirostris*) (Lucas, 1846)

d. Stripped or tiger shrimp (*Penaeus monodon*) (Fabricius, 1978)

e. Palaemonidae-Estuarine prawn from Decapoda (*Nematopalaemon hastatus*) (Aurivillius, 1898)

4. Status of marine fisheries production in Nigeria

The world fish production has drastically been affected by the marine fisheries production globally and in Nigeria. According to the FAO's [46] report, total fish production in the world was only 19.3 million tons in 1950, which increased tremendously to 163 million tons in 2009. Throughout history, marine fishing has always been the largest contributor to global fish production. As at 2009, marine capture fisheries contributed about half (49%) of the world fish production, in comparison with mariculture (21%), fresh water aquaculture (23%) and inland capture fishery (6%) [47]. The highest marine fisheries production was 87.7 million tons in 1996, while the global recorded production was 79.5 million tons in 2009. This implies that although the global fish production has increased, marine fisheries contribution to total fish production has been on the decrease since 1996.

Rabo et al. [41] reported the total fish caught by African fishers to be 6.30 million metric tons and that 3.80 million tons (about 60 percent) was from the marine waters with Nigeria being among the top African countries in terms of total fish catch. They contributed further that Nigeria's 2005 fish catch was 579,500 metric tons live weight and less than half of the catch was from inland waters. This illustrates that the Nigerian fish production has been dominated by marine fisheries (fishing and aquaculture).

A more recent report of the FAO [39] noted that the total world fisheries production has been on the increase from 145.9 million tons in 2009 to 167.2 million tons in 2014. It was also reported that marine fisheries contributed 101.1 million tons, which is about 69.3% of the total world fish production in 2009 [39]. The total marine fisheries in 2010 declined to 100.0 million tons (67.5%) out of the 148.2 million tons of world fish production the same year. The total marine fisheries production also increased to 105.8 million tons in 2011, but its contribution to total world fisheries production was only 68.0%. In 2012, marine fisheries decreased to 104.1 million tons contributing only about 66.0%, while total marine fisheries increased to 106.5 million tons in 2013 contributing 65.3% to world fisheries production. In 2013, the fisheries production increased to 167.2 million tons with marine fisheries contributing 108.2 million tons (64.7%). A closer look at the report of FAO [39] indicated that inland water aquaculture contributed more than inland water fisheries, while marine fisheries contributed more than marine aquaculture.

5. Marine fisheries regulations in Nigeria

A number of policies, decrees, and acts have been put in place by successive Nigerian governments as a way of regulating the stocks of marine fisheries resources in the country. These regulations include the Sea Fisheries Act of 1971, the Sea Fisheries (Licensing) Regulations of 1971, the Sea Fisheries (Fishing) Regulations of 1972, the Exclusive Economic Zone Decree of 1978, the Sea Fisheries Decree of 1992, and the 1995 Sea Fisheries Regulations. Each of them is discussed below.

5.1. The Sea Fisheries Act of 1971

Although conscious efforts at developing the nation's fisheries could be said to have started in 1941, there was no real national fisheries policy in place. During this period, there were some programs aimed at increased fish production through input supply at subsidized rates, technology transfer, and revolving loan schemes among fishermen [48]. The first national policy was put in place by the federal government with the advice of the Federal Department of Fisheries when the Sea Fisheries Decree was promulgated under the Decree No 31 of 1971 to control and regulate coastal fisheries. The Sea Fisheries Act is an act to make provisions for the control, regulation, and protection of sea fisheries in the territorial waters of Nigeria [49]. The act has 14 sections with Section 1 being on licensing of motor fishing boats; application for a license, grounds for issue of a license, and renewal of a license were detailed in Sections 2–4. Sections 5 and 6 were on appeals and returns, respectively, while Section 7 was on the enforcement of the Act. Section 8 prohibited the use of any explosive substance, or any noxious or poisonous matter that could destroy fish within the territorial waters of Nigeria. Offenses against the act and penalties for such offenses were detailed in Section 9, while any fishing boat and apparatus used in contradiction to this act shall be forfeited according to the government, as contained in Section 10. Section 11 provided the Minister of Agriculture the power to make regulations for furthering the interests of sea fishing industry in Nigeria and for giving effect to the provisions of this act. The interpretation of the contents of the act were explicitly stated in Section 12, whereas Section 13 repealed the 1961 Sea Fisheries (Lagos) Act, the 1965 Sea Fisheries Law, the 1967 Sea Fisheries (Motor Fishing Boats Licensing) Regulations, and the 1969 Sea Fisheries (Licensing) Regulations.

5.2. The 1971 Sea Fisheries (Licensing) Regulations

These contain six regulations and two schedules on the licensing of motor fishing boats. Application form for a license or renewal of a license to operate or to navigate a motor fishing boat within the territorial waters of Nigeria and the particulars that must be stated in such application as contained in Form A of Schedule I are prescribed in these regulations [43]. Form B of Schedule I prescribes the form of license to operate or navigate a motor fishing boat, while Schedule II contains the fees for licenses. It was, however, indicated that nothing in these regulations shall be applied to motorized and nonmotorized fishing canoes.

5.3. The 1972 Sea Fisheries (Fishing) Regulations

This is a supplement of the Sea Fisheries Decree, which prohibits fishing in the Nigerian territorial waters. With the 1972 Sea Fisheries Decree, fishing trawlers are restricted from

operating within the first 2 nautical miles of the continental shelf. The essence of this was to ensure that industrial vessels are not competing with local artisanal canoe fishers. It was the outcome of artisanal fishers' complaints that industrial fishing trawlers were destroying their fishing nets [50]. Etim et al. [51] noted that the regulation assigns exclusive right to the artisanal canoe fisheries to exploit the inshore area in order to reduce the conflicts between the industrial and artisanal sectors.

The provided regulations are that:

i. No fishing vessels (except canoes) shall fish within the first 2 nautical miles of the waters of the Nigerian Continental Shelf. This is the 'nontrawling zone.'

ii. Trawlers fishing in the inshore waters should use a mesh size of not less than 3.00 inches (76.0 mm) toward the cod-end and trawlers shrimping shall not use a mesh size less than 44.0 mm toward the cod-end. The minimum size of fish to be caught was also fixed at 3.00 cm.

iii. All catch should be landed at port, and that no part of it may be exported away from Nigeria at sea.

iv. Any part of the catch for export shall be exported in the usual manner and subject to any foreign exchange regulations for the exportation of such commodities from Nigeria.

v. No shrimp trawling is permitted in the inshore water of the Lagos-West fishing grounds.

vi. Penalties involving fines, imprisonment, or both are provided for those contravening the regulations [43].

5.4. The 1978 Exclusive Economic Zone Decree

The Exclusive Economic Zone Decree Act was promulgated by the Federal Government of Nigeria in 1978 in line with the provisions of the UN Convention on the Law of the Sea [50]. The Act empowers Nigeria to extend her territorial waters by 200 nautical miles seaward from the coast of Nigeria [52]. With this Act, the natural resources of the exclusive economic zone within the Federal Republic of Nigeria can be exploited under the Nigerian regulations. It also contains the penalties (fines, imprisonment, or both) for contravening the provisions of this act.

5.5. The 1992 Sea Fisheries Decree

The 1971 Sea Fisheries Act was repealed and replaced by the 1992 Sea Fisheries Decree in order to continuously promote the sustainability of the inshore fisheries and the fisheries of the EEZ in the country [52]. It was promulgated under the Decree No 71 of 1992 Laws of the Federation of Nigeria and contains 17 sections. The provisions of this decree were on the licensing of motor fishing boats, penalties for unlicensed motor fishing boats enjoying the rights of licensed boats, powers and duties of licensing officers, and the penalty for violating the provisions of this decree. Section 1 of the decree provided that only dully registered and licensed motor fishing boats and reefer vessels are allowed to be navigated within the territorial waters of the country [53]. The 1992 Sea Fisheries Decree also extended the restriction placed on industrial vessels from competing with local fishers to 5 nautical miles. Although the decree was silent on fish sizes that could be captured, it mandated the Nigerian Institute

for Oceanography and Marine Research (NIOMR), Lagos, to publish the minimum total length of different species that could be caught during each year [50].

5.6. Sea Fisheries Regulations of 1995

The 1995 Sea Fisheries Regulations originated from the Sea Fisheries Decree No 71 of 1992 and contains in addition to the provisions of the Sea Fisheries Decree 1992 Fish Inspection and Quality Assurance as the main text concerning the control of fishery products [52].

6. Constraints to optimal marine fisheries production in Nigeria

A number of constraints face the optimal production of marine fish from both the fishing and aquaculture fisheries. These constraints are as a result of threats to the marine fisheries resources and could be grouped into natural and human factors.

6.1. Natural factors

The natural factors affecting the marine fisheries resources include salinity, wind speed and direction, ocean currents, nutrient availability, carbon dioxide concentration in the ocean, strength of upwelling, rain and snow, as well as the interaction among these different factors [54, 55]. The consumption of small fish by large predator fish, mammals, and seabirds also constitutes a serious threat to certain fish species [56, 57].

In Nigeria, excessive pressure is put on inshore fishes because of Nigeria's relatively narrow continental shelf, which extends for about 15 km in the western area and ranges from 60 to 80 km in the eastern area [58]. This limits the trawlable area to 3.20 km^2 (27.9%) out of the 11.5 km^2, which Nigeria is blessed with [59, 60]. Lastly, the low-lying nature of the Nigerian coast makes it susceptible to storm surges, coastal erosion, and inundation of the coastal mangrove and wetlands, which destroy rare and fragile habitats for marine fish breeding and nursery [61].

6.2. Human factors

The human factors that constitute threats to fishery resources are categorized and discussed under three broad headings: overfishing, environmental activities, and climate change.

6.2.1. Problems of overfishing

Globally, and in Nigeria, overfishing is the primary human activity, which poses as threat to marine fishery resources. Overfishing occurs when so many fish are taken from a fish population such that the stock capacity to produce maximum sustainable yield on a continuous basis is diminished [62]. In Nigeria, overfishing is caused by several interrelated factors such as increase in population, ghost fishing, and problems associated with the creation of EEZ, and inadequate data, and high interest rates on loan.

6.2.1.1. Increase in population

Nigeria, which is currently the seventh largest country in terms of human population, has been projected to be the third largest country by year 2050 [63]. Although the domestic fish production has increased based on different programs of the Federal Government, this increase is at a slower pace when compared with the nation's growth rate, and hence, the increasing human population puts more pressure on the marine fishery resources. The FAO predicts that by 2030 an additional 37.0 million tons of fish per year will be needed to maintain current levels of fish consumption for an expanding world population [64]. This gap continues to grow on a daily basis as the world population increases.

6.2.1.2. Ghost fishing

According to FAO [39], ghost fishing is caused by abandoned, lost, or otherwise discarded fishing gear. Lost nets and those intentionally abandoned in the sea by fishermen continue to catch fish and nonfish species [65]. Although ghost fishing is under 1.00% of landed catches [66], according to a recent FAO and United Nations Environmental Program reports, the problem is likely to escalate due to the increased scale of fishing operations, introduction of highly durable fishing gear made of long-lasting synthetic materials, and lack of serious concern shown by the international community to address the problem [67].

6.2.1.3. Problems associated with the creation of EEZ

The creation of the EEZ also set into motion its own dynamic system leading to compliance and enforcement problems. The majority of coastal states, especially developing states, cannot afford the sophisticated patrol vessels or satellite vessel monitoring systems (VMS) required for monitoring and surveillance of the vast and turbulent waters of the EEZ with less risk. The inability of coastal states to effectively monitor and enforce conservation measures in their EEZ encourages fishing in the area by unauthorized persons including foreign fishing vessels, thus exacerbating the depletion and collapse of marine fish stocks [68].

6.2.1.4. Inadequate data and high interest rate on loan

The above problems are further compounded by the lack of relevant data and information on fishing vessels, catch landings, and fish stock biomass, especially in developing countries including Nigeria. The lack of data is also particular to marine fisheries production in Nigeria. For instance, while the inland aquaculture of finfish was put at 313.2 thousand tons, that of marine/coastal aquaculture of finfish and other aquatic animals and plants was either unavailable or considered as negligible [39]. High interest rates on investment loans have prevented prospective investors in the marine fisheries industry from taking loans from commercial, merchant, development, and even microfinance banks [21]. This thereby limits the marine fishery production in Nigeria.

6.2.2. Environmental factors

Environmental factors affecting the availability, adequacy, and affordability of fish demands of Nigerians as a result of the deplorable state of the marine fisheries resources include pollution of aquatic environments and destruction of habitat.

6.2.2.1. Pollution of aquatic environments

Pollution of the aquatic environments is a major threat to marine fish populations all over the world. Dumping of toxic waste in the sea and emptying of ballast water from ships into the sea are other human activities polluting the aquatic environment. The problem of invasion of exotic fish species is linked to ballast water from ships. In Nigeria, the sources of pollution of the aquatic environment are industrial waste, raw/untreated domestic sewage, run-off of fertilizers and pesticides, sand mining, construction of canals, and oil spills [69, 70]. Excluding unreported cases, more than 1.07 million barrels of oil were spilled in Nigeria from 1960 to 1997 [71–73]. The millions of tons of polythene bags and other types of nonbiodegradable debris that have been washed by rain water into the aquatic environment constitute new threats to marine fisheries.

6.2.2.2. Habitat destruction

Habitat loss and environmental degradation of coastal zones, wetlands, deltas, and mangrove areas due to developmental activities and growth in aquaculture constitute the main reasons for the collapse of marine fish species that spawn in freshwaters [74]. Habitat loss also occurs in the high seas through deep-sea fishing activities [75]. This situation is particular in Nigeria since the discovery of oil in the 1970s and consequent neglect of the agriculture by the government and citizens that fuelled rural-urban migration in the country. This has also led to increased population growth especially in urban cities and hence contributed to intense urbanization [76], especially along the coastal areas. The establishment of new coastal settlements, such as Victoria Garden City in Lagos and Eagle Island in Port Harcourt, led to the reclaiming of lagoons and filling of mangrove swamps and estuaries for building of social infrastructures and industrial estates [77].

6.2.3. Climate change

The most fundamental impact of climate change on fish is through increase in global temperature. The 2007 report of the Intergovernmental Panel on Climate Change (IPCC) reveals that global average surface temperatures over the last 100 years have increased by 0.74 ± 0.18°C, while the rate of warming over the last 50 years is almost double that of the last 100 years (0.13 ± 0.03°C vs. 0.07 ± 0.02°C per decade) [78]. Global warming is responsible for the unprecedented warming of the oceans [79]. Ocean warming globally affects marine fishery resources in many ways such as the destruction of coral reef ecosystems [80].

7. Conclusion

Marine fisheries have been found to contribute significantly to the global fisheries production as well as to Nigeria when compared with inland freshwater fisheries. However,

while production earned from inland fisheries has regularly been increasing, marine fisheries production has been fluctuated with increase at some time and with decrease at other times. Review of literatures also indicated that contribution of aquaculture to marine fisheries production has been low when compared to the marine fishing production. Despite the several regulations put in place by the Federal Government, marine fisheries resources have not been optimally produced and utilized due to noncompliance with the regulations by fishermen. The current trend in marine fisheries resources and production could then be regarded as deplorable and this has been blamed on both natural and human factors. It is recommended that the aquaculture of marine fishes should be intensified. Marine waters should also be protected against destruction and pollution as a result of human activities. Available marine fisheries regulations should be enforced and violators of the regulations should be punished as stipulated in the regulations, while some of the provisions of the regulations such as mesh size, fish size, etc. should be modified to allow for optimal marine fish production in Nigeria.

Conflict of interest

The authors hereby declare that there is no conflict of interest in this chapter preparation.

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